This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{144}} + \sqrt{4}i$$

The solution is Pure Imaginary, which is option D.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

D. Pure Imaginary

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$19 - 11^2 + 20 \div 7 * 13 \div 17$$

The solution is -99.815, which is option D.

A. $[141, 142.7]$

142.185, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-104.1, -101.6]$

-101.987, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[136.5, 141.4]$

140.013, which corresponds to two Order of Operations errors.

D. $[-100.3, -98.1]$

* -99.815, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 + 6i)(2 + 3i)$$

The solution is $-2 + 36i$, which is option E.

A. $a \in [-12, -1]$ and $b \in [-45, -33]$

$-2 - 36i$, which corresponds to adding a minus sign in both terms.

B. $a \in [33, 39]$ and $b \in [9, 15]$

$34 + 12i$, which corresponds to adding a minus sign in the first term.

C. $a \in [14, 21]$ and $b \in [17, 23]$

$16 + 18i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [33, 39]$ and $b \in [-13, -3]$

$34 - 12i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-12, -1]$ and $b \in [35, 40]$

* $-2 + 36i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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4. Simplify the expression below and choose the interval the simplification is contained within.

$$19 - 9^2 + 8 \div 5 * 4 \div 20$$

The solution is -61.680, which is option A.

A. $[-61.93, -61.53]$

* -61.680, this is the correct option

B. $[100, 100.05]$

100.020, which corresponds to two Order of Operations errors.

C. $[-62.15, -61.94]$

-61.980, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[100.18, 100.45]$

100.320, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{65}}{18} + \sqrt{-2}i$$

The solution is Irrational, which is option E.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Irrational

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-72 - 55i}{-7 + 3i}$$

The solution is $5.84 + 10.36i$, which is option E.

A. $a \in [11, 12]$ and $b \in [1.5, 3]$

$11.53 + 2.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [4.5, 7.5]$ and $b \in [600.5, 602.5]$

$5.84 + 601.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [338.5, 339.5]$ and $b \in [9.5, 12]$

$339.00 + 10.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [10, 11.5]$ and $b \in [-19, -17.5]$

$10.29 - 18.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [4.5, 7.5]$ and $b \in [9.5, 12]$

* $5.84 + 10.36i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(3 - 10i)(-5 + 8i)$$

The solution is $65 + 74i$, which is option A.

A. $a \in [63, 66]$ and $b \in [72, 75]$

* $65 + 74i$, which is the correct option.

B. $a \in [-17, -12]$ and $b \in [-84, -79]$

$-15 - 80i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [63, 66]$ and $b \in [-74, -69]$

$65 - 74i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-102, -92]$ and $b \in [24, 29]$

$-95 + 26i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-102, -92]$ and $b \in [-31, -22]$

$-95 - 26i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{121}{324}}$$

The solution is Rational, which is option C.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Rational

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\frac{11}{18}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 - 88i}{2 + i}$$

The solution is $-3.20 - 42.40i$, which is option D.

A. $a \in [17.5, 18.5]$ and $b \in [-89, -87]$

$18.00 - 88.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-4.5, -2]$ and $b \in [-213, -211]$

$-3.20 - 212.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [31, 33.5]$ and $b \in [-29.5, -27.5]$

$32.00 - 28.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-4.5, -2]$ and $b \in [-43, -41.5]$

* $-3.20 - 42.40i$, which is the correct option.

E. $a \in [-16.5, -15.5]$ and $b \in [-43, -41.5]$

$-16.00 - 42.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{3600}{36}}$$

The solution is Whole, which is option B.

A. Irrational

These cannot be written as a fraction of Integers.

B. Whole

* This is the correct option!

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 60.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
